STRATEGY-LED CONSTRUCTION: SUCCESS THROUGH A HUMAN-CENTERED APPROACH

Chamila Ramanayaka [1*] and James Olabode Bamidele Rotimi [2]

1. Construction Management Programme, School of Engineering, Auckland University of Technology, cramanay@aut.ac.nz *

2. Construction Management Programme, School of Engineering, Auckland University of Technology, jrotimi@aut.ac.nz

ABSTRACT

Performance statistics in the construction industry show that project and company failures have become widespread in the industry. Studies have recognized the need for new planning approaches, since existing approaches seem incapable to cope with increasing complexity, dynamism, uncertainties and uniqueness of construction projects. This doctoral study investigates a suitable complementary approach as a tool for construction project planning to achieve success in terms of time, cost, quality and client satisfaction. The paper discusses how a preliminary document analysis is used to seek a suitable pathway for subsequent phases of the doctoral programme. The preliminary study sought information on different strategies used by construction managers on past successful projects in the UK. The results are compared with past suggestions for successful project delivery. Different strategic approaches are reviewed for the feasibility of adopting a human-centered approach to for strategy in the construction industry. The latter part of the paper describes the limitation of the current study and presents a future research plan for a comprehensive understanding of strategy-led approaches in construction projects.

Keywords: Project success, Construction planning, Strategies

INTRODUCTION

Developing a human centered planning approach aims at providing solutions for issues that bother around construction project failures. The inabilities to cope with increasing complexities, dynamisms, uncertainties and unique nature of the construction industry are highlighted as deficiencies in current planning approaches that deserve attention (Wong & Ng, 2010). For example some authors ascribe philosophical reasons for these failures, saying that on-going practices are dominated by technical rationality that solves problems through reductionism (Dias, 2002). Therefore the current study aims at developing a holistic and complementary approach to current planning tools with the hope of achieving balance between cost, time, quality and client satisfaction under chaotic situations. Document analysis research technique was used as a preliminary scrutiny to determine different strategic solutions on past successful projects. Though strategy-led approaches could be recognized from the document analysis, there are limitations that emerged from the research approach which would be addressed in future studies. The current study is carried out under a larger doctoral study that uses both quantitative and qualitative research methods to complement the limitations of each of the two methodologies.

THE ROLE/LIMITATION OF CURRENT PRACTICES

Improved scheduling techniques have been suggested as solution to construction project failures (Belassi & Tukel, 1996). Four project scheduling techniques are therefore considered in terms of their abilities to aid project success. The scheduling techniques include: Critical Path Method (CPM), Project Evaluation and Review Technique (PERT), Critical Chain Planning Method (CCPM) and Earned Value Management (EVM).

Assuming unlimited duration and infinite resource availability, CPM seems to be somewhat improbable to construction project planning. Complementary analyses eliminating those inappropriateness such as cost-time trade-off analysis, resource levelling, cash flow management etc. are criticised due to reductionism (Menesi, 2010). Reductionism, the basis for technical rational approaches, inspires the practitioner to provide answers by dividing the whole into parts, but the parts cannot represent the emergent properties of the whole (Dias, 2002). In CPM, dealing with a sub-problem, may mean that other requirements are violated. Accurate estimation of crew's productivity and adding buffers between activities could minimize these drawbacks (Hegazy & Mensi, 2010). However the questions remain: how can project managers estimate crew's productivity and buffers appropriately? Conversely, suggested improvements are criticized because developments have contributed to additional issues rather than providing solutions. Since reasonable safety time is added to activity durations through probabilistic calculations, Rand (2000) sees that buffers are unnecessary. Further, since humans tend to leave lot of works to the last moment (Fallah, Ashtiani, & Aryanezhad, 2010), which is well-known as 'student syndrome', buffers can cause inefficient yields.

By the time PERT was developed, there had been no empirical studies available to find out typical activity duration's distribution (Cottrell, 1999) and he criticises the major assumption on beta distribution for PERT derivations. He finds that the error between estimated and actual values can go up to 33%. Further, it is hard for practitioners to calculate optimistic and pessimistic durations because people are not good at extreme values (Cottrell, 1999). Similarly, since construction projects operate in unique environments with unique activities, the relevance and availability of historical data is questionable.

Though there are many pros in CCPM over CPM/PERT such as the consideration of resource constraints, there are many cons developed around its reliability. Fallah et al. (2010) say that buffer calculation procedure has no dynamic nature because it adds a half from the sum of critical activity durations as the safe time at the end of a program. They identify this as a misleading protection, especially, for low risk environments. They introduce a new method by considering the level of uncertainties in activity basis, but long calculation procedure seems to be a hassle. Difference between mean and median, coefficient of variation, skewness and kurtosis must be calculated and compared to find convex combination for each activity in a project. Further, it has common issues as for CPM such as availability and appropriateness of historical data. In addition, there are many salient activities which do not reflect in prepared CCPM such as identification of system constraints and respective solutions.

EVM considers much on progress monitoring and decision making (Fleming & Koppelman, 2002) and measures schedule and cost variances by using actual cost, planned and earned values as parameters. The same principle seems to be applicable for EVM: planners must make decisions before playing with numbers. For example, the US Dept of Defence stresses the importance of proceeding cost performance calculation at right time (USAID, n.d) since construction projects progress usually with a wavering rate. There are more which seek human skills: implementation of appropriate managerial actions, develop revised estimates etc.

As a summary, people have put many efforts to improve planning tools with the aim of achieving project success. However, it seems that by developing planning tools only it is harder to think about a reliable solution. Further, Kessab, Hegazy and Hipel (2010) developed a decision support system (DSS) to resolve stakeholders' conflicts, but the current study believes that the industry needs to innovate approaches in a higher hierarchy level than this. Zhoa, You and Zuo (2010) introduced an innovative critical chain method to advance CCPM thorough an improved genetic algorithm. However, even for CCPM still there are a very few software packages developed such as Prochain, CCPM+ and Scitor Pro Suit which capacities are limited for general calculations (Patrick, 2004). The second fact is the less reliability of computer programs to implement heuristic procedures since those manifestations are 'greedy algorithms' which occasionally provide correct solutions with grossly sub-optimal results (Underhill, 1994). As a holistic solution, Artificial Intelligence (AI) is introduced, but for the construction industry, it reminds the Schon's dilemma of rigor or relevance as the industry is dominated by small scale companies that cannot afford hefty investments (Kumar, 2002). Keeping these suggestions and their drawbacks in mind, the current study therefore seeks a complementary approach which could help in the achievement of construction project success.

RESEARCH APPROACH

As a preliminary step towards determining a suitable pathway for subsequent phases of the doctoral programme on which this study is based, a document search and analysis was conducted. The analysis used archival information provided by the Chartered Institute of Building (CIOB), UK. Project evaluation seems to be an overall representation of corporate members of the CIOB, including management specialists, clients, design teams, construction project managers etc (CIOB, 2010). Archival analysis research strategy, a way of sorting and analysing past data, was selected due to three reasons: no control was needed from the investigator on actual events, the possibility of archival analysis to address 'what' type of questions and suitability to investigate past events (Yin, 2003). Qualitative information on winners of the Construction Manager of the Year Award (CMYA) based in the UK was sifted through to find common themes relating to three issues: 1/ ambiguous nature of construction projects for which the awards were made, 2/ discover industry's perception about project success and 3/ determine approaches that offer a bridge between ambiguous project natures and unambiguous success. The analysis was facilitated with the use of NVIVO 9 software, which is a qualitative research tool for data sorting and analysis. Information on the award winners were collected for the period from 2009 to 2011. This resulted in a total of 66 Construction Managers and 66 projects within the period that was considered for the study.

RESEARCH FINDINGS

The nature of construction projects

The first aspect analysed within the archival information obtained of the award winners (CMYA) is the nature of construction projects for which the awards were made. The key themes from the awards were categorised under four project characteristics: complexity, dynamism, uncertainty and uniqueness. A summary of this themes/categorisation is presented in Table 1. Although it was difficult to distinguish between themes like uncertainties and complexities, it became possible through the use of examples to arrive at clear differentiations. Therefore the four characteristics of projects for which the awards were made, and which serve to describe the ambiguities of construction projects are depicted in table 1.

Table 1: Construction Project Characteristics and their Meanings

Characteristics	meaning	Example
Complexity	Difficult to grasp due to complicated nature	Complex design, technology used, procurement methods, client requirements
Dynamism	Sudden and regular changes to project schedule	Change in scope, internal and external influences on project performance
Uncertainty	Unpredictable or unexpected project events	Unforeseen performance requirements (ground condition, resource supply)
Uniqueness	Novel approaches to project performance.	Novelty in the use of construction methods, type of project, procurement type or stakeholders

The frequency of project characteristics

Following the determination of the nature of construction projects, it was necessary to determine the frequency of occurrence of these themes within the award statements. In this way one could determine a ranking of the four project characteristics. Table 2 summarises the result of the frequency counts generated, first by sorting the information using NVivo software and then counting manually. The table is split into columns for each year of the awards and the last column showing the total frequency and percentage of occurrence. It can be observed from the table that for the 66 projects analysed, both complexity and uncertainty generated the highest frequency of occurrence (67 and 61% respectively). This is followed by dynamism (36%) and uniqueness (17%). From this result, one could deduce that the awards (CMYA) were made on the basis of the four project characteristics. Thus project success is determined from the abilities of the project managers on construction projects with those characteristics.

Table 2: Characteristics of CMYA award winners' projects

Characteristics	2009 (n=22)	2010 (n=22)	2011 (n=22)	Total (%) (n=66)
Complexity	15	15	14	44 (67%)
Dynamism	14	6	4	24 (36%)
Uncertainty	18	15	7	40 (61%)
Uniqueness	5	3	3	11 (17%)
Nothing above	2	2	1	05 (8%)

What is 'success' in construction projects?

The second objective was to determine success measures and the frequency of their occurrence. In this way, it is possible to get an indication about what the industry perceives 'success' to mean. The first column of table 3 indicates the success measures used on the projects for which awards (CMYA) were made. Further, it summarises the result of the frequency counts for each year and the last two columns indicates the total counts (or otherwise) of the success measures in the information provided about the awards. It can be observed from the table that for the 66 projects analysed, time and cost were the top most measures (76 and 74% respectively) in selecting the awardees. This does not mean however, that there was failure (100-P) under these measures, considering that only remarkable achievements are mentioned in the CMYA profiles analysed. Quality (64%) and client satisfaction (45%) were mentioned next to them. Table 3 shows other criteria were used for the selection of the CMYA and they include: sustainability, health and safety etc., but none of these measures were mentioned significantly within the project profiles, when compared to the top four measures. This implies that the industry considers cost, time, quality and client satisfaction, as key deliverables for project success and are measures by which project success is determined. This could be treated as an overall trend of the industry because the award evaluations were based on the input of a variety of project stakeholders.

Table 3: Successful outcomes of CMYA winners' projects

Success measure	2011 (n=22)	2010 (n=22)	2009 (n=22)	Total (n=66)	Total % (P)	100-P
Cost	17	18	15	50	76	24
Time	16	17	16	49	74	26
Quality	12	15	15	42	64	36
Client satisfaction	9	9	12	30	45	55
Sustainability, environment and corporate responsibility	1	2	1	4	6	94
Health, safety and welfare	1	2	2	5	8	92
Overall success only	3	0	0	3	5	95

What are the approaches which ensure 'success' in construction projects?

The last objective of the archival analysis considered two things: to find out successful approaches and their focus. This would identify key areas that need to be developed to achieve success. The Nvivo 9 software was used to deduce the types of strategies that awardees had implemented to cope with project issues and hence achieve successful outcomes. Although there is no universal definition for strategy, the study based its definition on strategy as 'that which could assist construction managers in decision making and problem solving within the complexities, uncertainties and dynamism of construction processes'.

Table 4: Strategy focuses of CMYA awardees

Strategy focus	2009 (n=22)	2010 (n=22)	2011 (n=22)	Total (n=66)	%
Effective use of technology	15	14	15	44	67
Improving project schedules and plans	12	12	10	34	52
Dealing with client's characteristics	10	8	10	28	42
Coping with site conditions	10	12	3	25	38
Smoothly Working with sub-contractors	7	8	7	22	33

To determine the focus of the strategic approaches used by the awardees, the study used 27 critical success factors identified from literature. There other factors were identified while sorting the information provided. Table 4 summarises the top five focus of strategies obtained from the study. The table shows the frequency counts for the different focus for each year, with a total (and percentages) for all the 66 projects analysed. 'Effective usage of technology' was the top most (67%) focus of strategies. Use of the right materials, better use of construction methods, the use of off-site fabrication etc. are some of the statements that were summed up under 'effective usage of technology. The second most highlighted strategy focus was 'improving project schedules and plans'. The frequency count indicated 52% and support to some extent for the existing trend that project success can be ensured by improving project scheduling and planning. The information provided showed that the merging of programmes (contractors and sub-contractors), segmental and independent programming, engaging supply chain into programmes, scheduling around identified critical elements etc. were construction managers' strategy focus on the projects they got awards for. However, contemporary research focal points such as probabilistic developments and adding buffers were not mentioned in strategists' focus.

Scheduling as well as technical focused strategies seem to be more formal compared to strategies that focused on relationship management. Engagement strategies mostly focused on 'dealing with client characteristics' (42%) and 'smoothly working with sub-contractors' (33%) which are placed in third and fifth places respectively. In rescheduling, the most common practice in the industry is to get necessary action to recover losses. However, in a proactive way, CMYA practitioners predicted probable consequences and rescheduled before losses would happen. Strategists went beyond their procurement obligations to ensure success. For example, unforeseen ground condition can trigger additional time and cost into the project which could possibly be claimed. However, the awardees used value adding strategies to ensure that projects could be run within the same budget though that was not their obligation. That may result indirect advantages such as ensuring smooth cash flow and winning client's commitments.

As a summary of the findings it can be seen that complexity, uncertainty, dynamism and uniqueness are threats for construction project implementation. Findings seem to comply with past researchers. Wong and Ng (2010) identifies that uncertainties, risk and variations are main triggers for project failures. Further, Smith, Merna and Jobling (2006) find that the primary targets of cost, time and quality are subject to risk and uncertainty. Uniqueness is significant because it makes management practitioners to ignore general rules (Ballard &

Howell, 1998). The document analysis shows that strategies can be used to mitigate those situations. Although strategic model development is relatively new for the construction industry (Kazaz & Ulubeyli, 2009), several authors identify the importance of strategies as successful remedies. Wong and Ng (2010) recommend that the industry needs regular performance evaluations and strategic applications to cope with dramatic changes. Further, when costly micro-computer solutions are impossible, it would therefore seem that strategies are the most important single factor for successful completions (Kumar, 2002). Archival analysis findings comply with past suggestions, but there are limitations of the study which arise the necessity of future studies.

DISCUSSION ON FUTURE STUDIES

By provided information, it is impossible to quantify (high or low) strategic impact on project performance. This limitation is to be addressed through quantitative aspects by using the hypothesis H1 that 'strategies are capable of improving construction project implementation under complex, dynamic, uncertain and unique situations so that successful outcomes are resulted in terms of cost, time, quality and client satisfaction'. H1 is to be tested using a questionnaire survey and validation interviews under the larger doctoral study that this paper is based upon. Three measures are used to verify/falsify H1: capability of strategies to improve project implementation, project characteristics in terms of complexity, dynamism, uncertainty and dynamism, and successful project outcomes. Ratios between targeted and achieved values for cost, profit, time, quality and client satisfaction are used as the dependant variables of the study. Both quality and client satisfaction will be measured using a scale of 1-10. Variations are to be considered. To evaluate strategic effects on project implementation, critical success factors used and emerged in the document analysis will be rated on a scale of 1-10 with an opportunity to eliminate unrelated factors. Multi-collinearity is to be considered to eliminate highly co-related factors. Complexities, dynamisms, uncertainties and uniqueness will be rated. Equation 1 will be used to predict strategic effects and their behaviours in achieving successful project outcomes by coping with project characteristics. Hundred and sixty awardees from the New Zealand Institute of Building have been identified for the study.

Success = *f* (strategic improvements, project characteristics) Equation 1

CONCLUSION

The study shows complexities, dynamism, uncertainty and uniqueness are common issues in the industry. According to literature, current suggestions on improvements are not capable of providing appropriate and adequate solutions. The preliminary document analysis implied that strategy could be used to handle complex situations. Strategies have suggested in other studies, but their appropriateness is still to be investigated quantitatively in future studies. Although construction project evaluation is to be done in contractors' perspectives, improvements in terms of cost, time, quality and client satisfaction can deliver advantages to all stakeholders.

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